JOINT ANNUAL REPORT

1961

VILLAGE OF MARKHAM

JOINT ANNUAL REPORT

ON

THE VILLAGE OF MARKHAM

SEWAGE TREATMENT PLANT

OWRC PROJECT NOS. 59-S-40 and 60-S-55

AND

WATER SUPPLY SYSTEM

OWRC PROJECT NO. 58-W-16

MARKHAM VILLAGE SEWAGE TREATMENT PLANT

AND

WATER SUPPLY SYSTEM

Operated for

THE VILLAGE OF MARKHAM

by

THE ONTARIO WATER RESOURCES COMMISSION

Mr. A. M. Snider	-	Chairman
Dr. A. E. Berry	-	General Manager
Mr. D. S. Caverly	-	Assistant General Manager, and Director, Division of Plant Operations.
Mr. B. C. Palmer	-	Assistant Director, Division of Plant Operations.
Mr. C. W. Perry	-	Supervisor of Water Works, Division of Plant Operations.
Mr. P. J. Osmond	-	Project Engineer, Division of Plant Operations.
Mr. W. A. Marshall	-	Construction Engineer, Division of Construction.

HISTORY

In 1958, the Village of Markham, in conjunction with the OWRC and the consultant, R. V. Anderson, initiated plans for a new activated sludge type sewage treatment plant, a sanitary sewer system, a sewage lift station, trunk sewers and appurtenances. This proposed sewage scheme was divided into two projects. OWRC project #59-S-40 covered the treatment plant and sewer system, while OWRC project #60-S-55 covered the lift station and West Rouge trunk. Ontario Municipal Board approval for 59-S-40 was granted on June 25, 1959 and the final agreement between the Village of Markham and the OWRC was signed on July 14, 1959.

On August 21, 1959, a contract for the construction of the sanitary sewer system was awarded to Marino Construction Ltd. The cost of the 5.8 miles of sewers was initially estimated at $266,576.02. Pearce Construction Co. was awarded, at the same time, a contract for the construction of the sewage plant at an estimated cost of $288,239.30.

OWRC project #60-S-55 was approved by the Ontario Municipal Board on February 9, 1960 and the final agreement between the Village and the Commission was signed on January 3, 1961. Swansea Construction Ltd. was awarded the contract for the construction of the sewage lift station and West Rouge trunk sewer on December 28, 1960 at an estimated cost of $240,648.71.

Construction on project 59-S-40 commenced in September, 1959 and was substantially completed in December, 1960. Project #60-S-55 was commenced in January, 1961 and was substantially completed in July, 1961.

The completed works were officially opened on November 7, 1961 by Mr. A. A. Mackenzie, M.P.P., and Reeve J. V. Fry who jointly

cut the traditional ribbon at a ceremony held at the sewage treatment plant.

PLANT DESIGN DATA

The Markham Village sewage treatment plant, at present, is capable of providing complete treatment plus heated sludge digestion for 334,000 gallons of sewage per day. The plant will presently serve 3340 persons and can be ultimately enlarged to serve 13,300 persons with an equivalent flow of 1.3 MGD.

Facilities presently include two temporary pumping manholes on the collector system; one raw sewage lift station located on the plant grounds; an influent works equipped with a barminutor and air-degritter; one primary clarifier; one diffused air aeration tank; one secondary clarifier; a chlorine contact chamber; and parshall flume; two sludge drying beds; a heated, floating roof digester, and a control building.

PUMPING MANHOLES

The two pumping manholes located on the sanitary sewer system are only temporary and will not be needed as the pumped sewage, after the sewer system expansion program is completed, will be able to flow by gravity to the plant site.

RAW SEWAGE LIFT STATION

The West Rouge trunk sewer which serves the westerly portion of Markham Village empties into the wet well portion of the raw sewage lift station approximately 35 feet below the normal plant elevation. The sewage first passes through a bar screen with bars at 1 1/2" centers and is then lifted to the influent works by either one of two vertical dry well centrifugal pumps each

having a capacity of 292 gpm at 40' total dynamic head. The capacity of this station is 540,000 gallons per day with both pumps running continuously. The pumps are each powered by a 20 HP electric motor and there is no stand-by power supply.

INFLUENT WORKS

Sewage flowing in an 18" influent sewer enters the plant through the influent works which provides screening, shredding and grit removal. The screening and shredding is accomplished as the sewage passes through an 18" Model C. barminutor. Grit is removed in a 4165 gallon air-degritter which has a retention time of 18 minutes at design flow. By-pass channels are provided for both units. The barminutor by-pass is equipped with a coarse bar screen.

PRIMARY CLARIFIER

From the air-degritter the sewage flows into one rectangular primary settling tank. This tank measures 42' x 12' x 7'9" deep and is equipped with chain driven travelling combination scum skimmers and sludge collectors. The retention time in this tank is 1.75 hours at design flow.

The sludge and scum collected in the primary clarifier is periodically pumped directly to the digester.

AERATION TANK

The effluent from the primary clarifier flows directly into the aeration tank. This tank measures 51' x 22' x 15' deep and has a retention of 7.5 hours with no return activated sludge flow. The circulation in this tank is achieved by introducing air at approximately 5 lbs. pressure through diffusers near the

bottom of the tank. This air is pressurized by a 12 x 11 blower which is powered by a 30 HP electric motor, and is capable of producing 1.33 cu. ft. of air per gallon of sewage at design flow. There is no auxiliary power source for this equipment.

SECONDARY CLARIFIER

From the aeration tank the sewage or mixed liquor, as it is now called, flows into the secondary clarifier. This tank measures 42' x 12' x 10'6" deep and is equipped with chain driven travelling sludge collectors. The retention time in this tank is 2.4 hours at design flow.

The sludge collected in this tank is transferred into an activated sludge pit, from which it is pumped to either the primary clarifier or the aeration tank.

CHLORINATION

The secondary clarifier effluent flows into the chlorine contact chamber where its bacterial content is reduced by the addition of chlorine. This tank measures 20' x 11'4 1/2" x 8'6" deep and has a retention time of 52 minutes at design flow. Chlorine is fed to this tank through a gas chlorinator which has a capacity of 40 lbs. per day. The effluent from this tank flows to the Rouge river.

The sewage flow before it enters the chlorine contact chamber is measured in a parshall flume. This measurement is transferred by a float system to the control building where it is recorded and totalized.

DIGESTION

Sludge and scum collected in the primary clarifier is pumped to the digester and heated to a temperature of approximately 95^{o}F.

The digester measures 45' in diameter and has a side wall depth of 20'. Its capacity of 35,225 cu. ft. or 219,800 gallons allows for 10.5 cu. ft. per capita at the present design flow or at ultimate capacity 2.6 cu. ft. per capita.

The raw sludge pumped to the digester is broken down by anaerobic bacterial action into a thick, black, odourless sludge, a relatively clear supernatant which is returned to the aeration tank and a methane gas of relatively low quality which can be used to heat the digester. The above process is accelerated by mixing and heating. The digested sludge is then disposed of by either liquid sludge haulage or run onto the sludge drying beds where it is dewatered prior to subsequent removal. Oil is used as a stand-by fuel for heating the digester.

CONTROL BUILDING

The control building houses an office, laboratory, main control panel, chlorinator room, air blower, raw sludge pump, return activated sludge pump, a stand-by pump, a water seal unit, a heat exchanger and a small work shop. There is also ample room for the installation of future equipment necessary for the ultimate expansion of the plant.

OPERATING DATA

Due to the failure of the totalizer or integrator on the flow recorder to record any flow below the rate of 90,000 gallons per day, and the fact that the flow is below this figure most of the time, no conclusive flow results are available. Therefore, since the writer has assumed, after studying the charts, an average daily flow of 75,000 gallons, any operating data will not be conclusive.

The sewage treatment plant operated continuously in 1961 from March 12th on, a period of 294 days. This represents, at 75,000 gallons per day, a total flow for 1961 of 22.05 million gallons. The maximum recorded flow rate was 200,000 GPD and the minimum recorded flow rate was 10,000 GPD.

The plant, over the past year, has been very difficult to operate efficiently due to the very low flow relative to the design flow. The total oxidation process, adopted for the plant last spring, was converted with much difficulty to the standard activated sludge process last fall. The plant is now utilizing this process quite successfully.

There have been numerous minor problems with equipment and piping, however, most of these have been rectified. These difficulties are usually associated with a new plant and are not extraordinary.

The next two pages are a tabulation of the available operating results, however, it must be remembered that they are by no means conclusive.

PLANT PERFORMANCE DATA

DATE	INFLUENT		EFFLUENT		% REMOVAL	
	B.O.D.	S.S.	B.O.D.	S.S.	B.O.D.	S.S.
Apr. 24	85	148	12	74	85.9	50.0
May 1	100	154	18	44	82.0	71.5
8	165	102	25	50	85.0	51.0
15	190	276	24	32	87.4	88.4
29	145	238	15	28	89.6	88.2
June 5	185	194	23	32	87.5	83.5
12	115	524	22	26	80.9	95.2
19	95	204	8	46	91.6	77.5
July 4	145	166	2.8	42	97.9	74.7
10	300	294	5.6	50	98.0	83.0
17	205	272	1.6	42	99.2	84.6
24	170	218	3.2	22	98.3	90.0
Aug. 8	235	374	3.6	24	89.9	93.6
14	300	414	3.6	56	98.7	84.1
21	235	372	2.8	44	98.9	88.2
28	230	240	10	54	95.7	77.5
Sept. 11	205	394	7.2	28	96.6	92.8
18	245	440	8.4	32	96.8	92.8
25	340	334	11	30	96.9	91.0
Oct. 2	375	516	22	20	94.1	96.0
16	390	438	13	34	96.7	92.2
23	245	338	9.2	44	96.4	87.0
Nov. 27	305	292	2.8	18	99.0	93.9
Dec. 11	285	326	39	26	86.3	92.0
Average	220	303	12.2	37	94.5	87.8

CHLORINE USAGE

MONTH	LBS. CHLORINE	LBS. PER M.G. SEWAGE	DOSAGE R.P.M.
June(16-30)	72	64	6.4
July	176	76	7.6
August	180	77	7.7
September	194	86	8.6
October	196	84	8.4
November	172	79	7.9

Total chlorine used = 990 lbs. at an average dosage of 7.9 ppm.

POWER CONSUMPTION

MONTH	K.W.H.	K.W.H./ M.G. SEWAGE
March(12-31)	140	98
April	206	92
May	204	88
June	176	78
July	177	76
August	192	82
September	178	76
October	192	82
November	215	96
December	213	91

Total Power Consumed = 1893 K.W.H. at an average consumption of 86 kilowatt hours/million gallons sewage.

COST DATA

The following information is a summary of the capital and operating cost data for 1961 plus construction costs. Following this will be found a statement of the actual expenditures during 1961 as well as a forecast of 1962 expenditures.

The total actual construction cost for project numbers 59-S-40 and 60-S-55 as of December 31, 1961 was $837,307.00 which is broken down as follows:

Project 59-S-40

Sewer system	$204,862.51
Treatment facilities	286,260.15
Engineering	25,106.22
Operational supplies	1,757.42
Equipment	86,480.58
Miscellaneous (property, interest, OMB charges, etc.)	3,744.19
Sub Total	$608,211.07

Project 60-S-55

Lift station and West Rouge trunk sewer	$236,777.60
Engineering	20,054.26
Miscellaneous (property, interest OMB charges, etc.)	10,606.32
	$267,438.18
Less Winter Works subsidy	38,342.25
Sub Total	$229,095.93
Total (Both projects)	837,307.00

1. Per Capita Cost - 3340 persons

(a) Capital Cost	
- sewer systems	$ 143.80
- treatment facilities	106.90
Total	$ 250.70
(b) Annual Cost (1961)	
- operating cost	$ 4.27
- debt retirement, interest and reserve	15.47
Total	$ 19.74

2. Per Household Cost (3.4 persons per household)

(a) Capital Cost	
- sewer system	$ 488.92
- treatment facilities	363.46
Total	$ 852.38
(b) Annual Cost (1961)	
- operating cost	$ 14.52
- debt retirement, interest and reserve	52.60
Total	$ 67.12

3. Treatment Costs

- cost per 1000 gallons	$ 0.65
- cost per million gallons	646.83
- cost per day (0.075 MGD)	48.51

4. Daily Cost per Capita

- includes operating and capital	$ .0209

Forecast of 1962 Expenditures

	1962		1961 Budget *
Payroll	$ 8,655.00		$ 7,200.00
Fuel	1,000.00		1,000.00
Power	1,700.00		2,000.00
Water	550.00		
Chemicals	200.00		300.00
General Supplies	1,000.00		1,200.00
Equipment	1,400.00		400.00
Maintenance and Repairs	400.00		400.00
Sludge Haulage			
Sundry	400.00		400.00
	$15,305.00		$12,400.00
Contingencies 10%	1,530.00	9%	1,100.00
	$16,835.00		$13,500.00

* This forecast represents costs for 9.5 months operation only.

ONTARIO WATER RESOURCES COMMISSION

PROJECT OPERATION STATEMENT

BUDGET TO DATE $13,000.00

ACTUAL TO DATE $14,262.70

OPERATION	$	%
BUDGET	13,000	100
ACTUAL	14,263	110
OVER		10

PROJECT MARKHAM VILLAGE

DATE	EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIP.	REPAIR & MTCE.	WATER	SUNDRY
JANUARY	275 36			85 54	139 22						50 60
FEBRUARY	973 04	542 66			149 35		32 69				248 34
MARCH	863 92	622 99			132 66		108 27				
APRIL	1,489 14	595 96		225 14	155 75	3 64	162 85			309 06	36 74
MAY	910 52	595 96			130 91	2 44	179 31				1 90
JUNE	1,120 71	737 59			290 13	9 13	41 81				42 05
JULY	798 56	599 84			140 52		13 37				44 83
AUGUST	1,189 66	934 06			148 74		3 27				103 59
SEPTEMBER	890 37	619 04		31 36	139 18	3 19	39 75	57 85			
OCTOBER	1,798 48	619 04		153 90			145 15			524 87	209 71
NOVEMBER	1,386 82	619 04			152 30	241 97	299 98				73 53
DECEMBER	2,566 12	786 93			301 11	CREDIT 70 00	129 47			467 08	1,097 34
	14,262 70	7,273 11		495 94	1,879 87	190 37	1,155 92	57 85		1,301 04	1,908 63

PERSONNEL

The Markham Village Sewage Treatment Plant is presently under eight hour supervision each day. The plant has a complement of two men, the Chief Operator, Mr. I. E. Baron, and the Operator, Mr. E. C. Brophy. Both these men were hired as a result of interviews, conducted by Markham Village and OWRC officials, which were held on November 24, 1960. Mr. Baron, formerly a Commission employee at the Markham Township pumping station, commenced employment at the sewage plant on February 1, 1961, while Mr. Brophy commenced work on February 13, 1961. Both men have, during the past year, shown that they are very capable of operating the plant efficiently and economically.

SUMMARY AND RECOMMENDATIONS

It is very difficult at this time to draw any definite conclusions regarding the operation of the plant as the flows have been so much below normal. However, the plant has operated well during the few periods of normal loading which were experienced last year.

The 1962 forecast of expenditures, higher by approximately $3,300 than the 1961 forecast, is by no means excessive as the 1961 figure allowed for only 9 1/2 months operation.

It is recommended that, due to the large amounts of municipal water used in the plant for foam control, an independent spray system, using the plant effluent, be installed. This item has been budgeted for in the 1962 forecast and will pay for itself in water saving within a year.

It is also recommended that a sludge splitter box be installed to provide a control over the waste and return sludge. It is very difficult at present to return sludge with any degree of control. This item has also been budgeted for.

WATER PUMPING STATION

HISTORY

In 1957, the Village of Marham, in conjunction with the OWRC and the consultant, R. V. Anderson, initiated plans for a new water pumping station and 12" feeder main. This proposed scheme, OWRC project #58-W-16, was approved by the Ontario Municipal Board on August 28, 1958 and the final agreement between the Village of Markham and the OWRC was signed on August 25, 1958.

During the early fall of 1958, a contract for the construction of the pumping station and feeder main was awarded to Manganaro Bros. Ltd., at an estimated cost of $29,510.02. At the same time, a contract was awarded to International Water Supply Ltd. for the installation of the necessary pumping equipment and controls at an estimated cost of $12,700.00.

Construction of this project commenced on October 30, 1958 and was substantially completed during the summer of 1959.

DESIGN DATA

The Markham Village water pumping station was located over an existing well in an area well known for its flowing wells. Water is lifted by a deep well pump driven by either a 60 HP electric motor or through a right angle drive by a 75 HP gasoline stand-by engine. The electric motor will produce 700 gallons per minute or 1,008,000 gallons per day while the gasoline engine will produce 1,000 gallons per minute or 1,440,000 gallons per day. A 10" Clayton Valve controls the pressure output of the pump and also eliminates water hammer conditions on the distribution system. Operation of the pump is controlled by a water head at Markham's elevated tank. This head is transferred into a pressure reading which is, in turn, converted to an electrical impulse. The electrical impulse is constantly being transmitted to the control panel at

at the pumping station. Pump start-ups and shut-offs are controlled by the strength of the impulse which is in turn regulated by the amount of water in the elevated tank. Water production is measured at the pumping station by a propeller type flow meter. There is no treatment provided.

OPERATING DATA

The Markham Village Water Pumping Station itself operated without any problems during 1961. However, it was affected twice during the year due to the failure or mal-adjustment of exterior controls. Controls were altered in June so that the elevated tank could be inspected and there was considerable difficulty in returning the system to normal operation after the inspection. In the late fall of 1961 the signal line between the pumping station and elevated tank snapped and was found to be inadequate over spans to which it was subjected, particularly during wind storms. The pumping station was operated manually for approximately four days while a new signal line was installed by the Public Utilities Commission. The Division of Plant Operations would like to thank the PUC crews under the direction of Mr. A. Eadie, for their cooperation during the last year.

Samples for water quality were taken regularly for analysis to the OWRC Laboratory and a program for chemical analysis of the water is being set up for 1962 as well as the quality analysis.

The following information is a tabulation of the flow results for 1961 and following this is a record of the power consumption per month:

MONTH	TOTAL FLOW (M.G.)	MAXIMUM DAY (GALLONS)	MINIMUM DAY (GALLONS)	AVERAGE DAILY FLOW (GALLONS)
JANUARY	6.45	250,700	183,100	208,000
FEBRUARY	6.46	252,300	185,200	230,700
MARCH	6.53	268,100	186,700	210,500
APRIL	6.08	248,500	161,400	202,600
MAY	7.54	305,300	179,600	243,000
JUNE	7.94	330,600	209,300	264,200
JULY	7.02	295,700	157,000	226,400
AUGUST	8.04	362,900	137,500	259,300
SEPTEMBER	8.32	386,000	140,800	277,500
OCTOBER	7.83	303,200	207,600	252,400
NOVEMBER	6.63	256,000	182,900	210,800
DECEMBER	6.34	253,600	183,300	210,900

Average Monthly Flow = 7,115,000 gallons

Average Maximum Day for Year = 292,700 gallons

Average Minimum Day for Year = 176,200 gallons

Average Daily Flow for Year = 233,000 gallons

Total Flow for 1961 = 85,380,000 gallons

POWER CONSUMPTION

MONTH	K.W.H.	K.W.H./ 1000 GALLONS
January	10,300	1.61
February	9,900	1.53
March	8,800	1.35
April	8,300	1.36
May	8,200	1.09
June	7,700	0.97
July	7,300	1.04
August	8,400	1.04
September	8,600	1.03
October	8,900	1.14
November	9,200	1.39
December	10,600	1.62

Power consumed in 1961 = 106,200 KWH

Average KWH/1000 gallons = 1.24

COST DATA

The total expenditures, $1,720.44, for 1961 were solely for power except for approximately $20.00. This, however, does not mean that monies should not be set aside in the 1962 forecast for items such as maintenance, repair & equipment.

The following information is a summary of the capital and operating cost data for 1961. Following this will be found a forecast of 1962 expenditures as well as a summary of 1961 expenditures.

The total construction cost for this project, 58-W-16, as of December 31, 1961, is $45,938.17 which is broken down as follows:

Pumping station and main	$27,540.02
Equipment	13,134.78
Engineering	4,055.58
Miscellaneous (property, interest OMB charges, etc.)	1,207.79
Total	$45,938.17

1. Annual Cost (1961) per person (4300 persons)

- operating	$ 0.40
- debt retirement, interest & reserve	1.03
Total	$ 1.43

2. Annual Cost (1961) per household (3.4 persons)

- operating	$ 1.36
- debt retirement, interest & reserve	3.50
Total	$ 4.86

3. Water Production Cost

(a) Operating only

- cost per thousand gallons	$ 0.02
- cost per million gallons	20.00
- cost per day (233,000 GPD)	4.66

(b) Operating, Debt Retirement, Interest and Reserve

- cost per thousand gallons	$ 0.072
- cost per million gallons	72.00
- cost per day (233,000 GPD)	16.78

4. Daily Cost per person

(includes capital and operating)	$ 0.39

Forecast of 1962 Expenditures

	1962	1961 Expenditures
Power	$2,000.00	$1,701.36
General Supplies		10.17
Equipment	200.00	
Maintenance and Repair	200.00	
Sundry	300.00	8.91
	$2,700.00	$1,720.44
Contingency 10%	270.00	
	$2,970.00	